CLAIMS

[Claim(s)]
[Claim 1]By making a cooling water circuit characterized by comprising the following circulate through cooling water via a circulating pump at the time of operation of a device, In a fuel cell type power plant with which cooling of said fuel cell is made by said condensator, While providing bypass piping which provides a heating method in both ends of said fuel cell, and connects said water supply piping and said drain piping with 1 side of said fuel cell, A fuel cell type power plant characterized by forming a small sized pump made to circulate through cooling water heated via said heating method on a lesser circulation way included said condensator and said bypass piping during said bypass piping at the time of shutdown of a device.
A condensator attached in a fuel cell.
Water supply piping which performs feed water to said condensator.
Drain piping which performs wastewater from said condensator.

[Claim 2]By making a cooling water circuit characterized by comprising the following circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects said water supply piping and said drain piping with 1 side of said fuel cell in a fuel cell type power plant with which cooling of said fuel cell is made by said condensator, A fuel cell type power plant having established a heating method during said bypass piping, and forming a small sized pump made to circulate through cooling water heated by said heating method in a lesser circulation way included said condensator and said bypass piping at the time of shutdown of a device.
A condensator attached in a fuel cell.
Water supply piping which performs feed water to said condensator.
Drain piping which performs wastewater from said condensator.

[Claim 3]By making a cooling water circuit characterized by comprising the following circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects said water supply piping and said drain piping with 1 side of said fuel cell in a fuel cell type power plant with which cooling of said fuel cell is made by said condensator, A fuel cell type power plant forming a small heating pump circulated heating cooling water on a lesser circulation way included said condensator and said bypass piping at the time of shutdown of a fuel cell during said bypass piping.
A condensator attached in a fuel cell.
Water supply piping which performs feed water to said condensator.
Drain piping which performs wastewater from said condensator.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the fuel cell type power plant which has a fuel cell of a water cooling system.
[0002]

[Description of the Prior Art]Since a fuel cell generates heat by an electromotive loss at the time of power generation, it cools by a certain means and it is necessary to make it the temperature of this fuel cell not rise generally more than prescribed temperature. In [drawing 6 is a cooling-system figure of the circumference of the fuel cell of the conventional fuel cell type power plant shown in JP,2-260370,A, and] a figure, 1 For example, the fuel cell with which many cells are laminated by the sliding direction, the condensator with which 2 is inserted for every cell of a predetermined number into this fuel cell 1, The water supply piping by which 3 supplies cooling water to the condensator 2, the drain piping in which 4 picks out cooling water from the condensator 2, The steam separator with which 5 is connected with the end part of the drain piping 4, and 6 are taken out from the lower part of the steam separator 5, The circulating pump of meteoric water piping connected with the water supply piping 3, and the cooling water in which 7 was provided into the water supply piping 3, Makeup water piping and 11 are steam pipings the drum heaters of the power use provided in the steam separator 5 8, the cooling water circuit in which 9 is formed of the steam separator 5, the meteoric water piping 6, the water supply piping 3, the circulating pump 7, the condensator 2, and the drain piping 4, and 10.
[0003]Operation of this fuel cell type power plant is explained below. If the fuel cell 1 is operated and power generation is started with this fuel cell type power plant, the fuel cell 1 will generate heat by that electromotive loss, and temperature will rise. For this reason, when the circulating pump 7 is started, and the cooling water in the steam separator 5 is sent in the condensator 2 through the water supply piping 3 and evaporates within this condensator 2, the generating heat of the fuel cell 1 is absorbed and the temperature of this fuel cell 1 is maintained to a predetermined operating temperature. And the cooling water of the vapor-liquid mixed phase discharged from the condensator 2 is emitted in the steam separator 5 via the drain piping 4, and vapor-liquid is separated by this steam separator 5. And while the load side which steam is adjusted to predetermined pressure and needs steam via the steam pipings 11 is supplied, it circulates through saturated water again with the circulating pump 7 through the meteoric water piping 6.
[0004]While new cooling water is supplied via the makeup water piping 10 by the steam emitted to the load side by the steam pipings 11, The amount of supply of the steam to a load side is maintained by constant value by the drum heaters' 8 operating and generating the steam which runs short within the steam separator 5 by the load change of the fuel cell 1, etc., if the amount of evaporation of the cooling water by the condensator 2 falls.
[0005]Now, when operation of the fuel cell type power plant which has the fuel cell 1 of the above water cooling types is suspended, in order to prevent freezing of the electrolyte currently held in the fuel cell 1, for example, phosphoric acid, It is necessary to hold the temperature of this fuel cell 1 more than prescribed temperature (in for example, the case of phosphoric acid 50-60 **). For this reason, operating the drum heaters 8 and holding the temperature of cooling water more than prescribed temperature, even if operation of a device is suspended. This cooling water is circulated all over the cooling water circuit 9 with the circulating pump 7, and prevention of electrolytic freezing is achieved by heating the fuel cell 1 via the condensator 2 more than prescribed temperature.
[0006]As shown by drawing 7, the electric heaters 12 and 12 are formed in a lower end part on the fuel cell 1, the electric heaters 12 and 12 are operated at the time of the shutdown of a device, the temperature of the fuel cell 1 is held beyond a predetermined value, and there are some by which prevention of electrolytic freezing is made.
[0007]

[Problem(s) to be Solved by the Invention]However, when operating the drum heaters 8 and circulating cooling water all over the cooling water circuit 9 at the time of the shutdown of a fuel cell type power plant, since there was much holding water quantity in this cooling water circuit 9, the power usage of the drum heaters 8 increased and the technical problem that operating cost will go up occurred. In order to circulate cooling water all over the cooling water circuit 9, when driving the large-sized circulating pump 7, the power usage also had the technical problem that it will be large, and operating cost will go up and carry out also by this.
[0008]When heating a lower end part with the electric heaters 12 and 12 on the fuel cell 1, In order to secure the temperature of pars intermedia more than prescribed temperature since the temperature of pars intermedia does not rise easily on the fuel cell 1 compared with a lower end part as shown by drawing 8, The top needed to heat the lower end part unnecessarily, and while causing increase of power usage and causing the rise of operating cost, the technical problem that enlargement of a device will be caused with enlargement of the electric heaters 12 and 12 occurred.
[0009]The purpose of this invention is as follows.
It is made in order to solve the above technical problems, and reduction of ********** can be aimed at in the anti-icing of the electrolyte of the fuel cell at the time of the shutdown of a device.
Provide the fuel cell type power plant which can also attain miniaturization of a device.

[0010]
[Means for Solving the Problem]A condensator with which an invention of the 1st of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which provides a heating method in both ends of a fuel cell, and connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having formed a small sized pump made to circulate through cooling water heated via a heating method on a lesser circulation way which included a condensator and bypass piping at the time of shutdown of a device during bypass piping.
[0011]A condensator with which an invention of the 2nd of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having established a heating method during bypass piping and having formed a small sized pump made to circulate through cooling water heated by a heating method in a lesser circulation way included a condensator and bypass piping at the time of shutdown of a device.
[0012]A condensator with which an invention of the 3rd of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having

formed a small heating pump circulated heating cooling water on a lesser circulation way included a condensator and bypass piping at the time of shutdown of a fuel cell during bypass piping.
[0013]
[Function]In the invention of the 1st of this invention, during operation of the device with which power generation by a fuel cell is made, a cooling water circuit with water supply piping, a condensator, and drain piping is made to circulate through cooling water with a circulating pump, and a fuel cell is cooled via a condensator. When operation of a device is suspended, while operating a heating method and heating a fuel cell, the small sized pump formed during bypass piping is operated, and the lesser circulation way having contained bypass piping and a condensator is made to circulate through cooling water. The heat given to the fuel cell by the heating method is also told to the cooling water side via a condensator, the whole is uniformly heated by prescribed temperature and, as for a fuel cell, freezing of the electrolyte of a fuel cell is prevented by this. In this case, since the holding water quantity of the cooling water in a lesser circulation way is also small, it is small and can clear up that heating quantity, while it can perform uniform heating of a fuel cell via a condensator, even if a heating method is attached to the both ends of a fuel cell.
[0014]When operation of a device is suspended, the small sized pump and heating method which were established during bypass piping are operated, and the lesser circulation way having contained bypass piping and a condensator is made to circulate through cooling water in the invention of the 2nd of this invention. The cooling water heated by the heating method flows into a condensator, a fuel cell is heated by prescribed temperature and freezing of that electrolyte is prevented by this.
[0015]The small heating pump formed during bypass piping is operated, and it is made to circulate in the invention of the 3rd of this invention, when operation of a device is suspended, heating cooling water on the lesser circulation way having contained bypass piping and a condensator. It flows into a condensator, cooling water being heated with a small heating pump, a fuel cell is heated by prescribed temperature and freezing of that electrolyte is prevented by this.
[0016]
[Example]Hereafter, the example of this invention is described about a figure.
example 1. -- this Example 1 is one example concerning the invention of the 1st of this invention. Drawing 1 is a cooling-system figure of the circumference of the fuel cell 1 of the fuel cell type power plant in which Example 1 of this invention is shown, gives identical codes to a portion the same as that of the conventional fuel cell type power plant shown by drawing 6, or considerable, and omits that explanation.
[0017]The bypass piping of the small size with which 20 connects the water supply piping 3 and the drain piping 4 in a figure, The small sized pump of small capacity with which 21 was provided during this bypass piping 20, the lesser circulation way of the cooling water in which 22 is constituted including the condensator 2 and bypass piping 20 grade in the fuel cell 1, The valve provided in the valve by which 23 was provided in the both-ends side of the bypass piping 20, the water supply piping 3 by which 24 adjoins the lesser circulation way 22, and the drain piping 4, and 25 are the electric heaters used as the heating method of this fuel cell 1 provided in the lower end part on the fuel cell 1.
[0018]Operation of this fuel cell type power plant is explained below. While the valves 23 and 23 are closed during operation of a device, the valves 24 and 24 can open and cooling water can

circulate through the inside of the cooling water circuit 9. And while electric power is taken out by operation of a device with the fuel cell 1, by the drive of the circulating pump 7, cooling water circulates through the inside of the cooling water circuit 9, and the fuel cell 1 is maintained by fixed operating temperature by collecting the generating heat as steam at the steam separator 5 side.

[0019]If operation of a device is suspended next, while the valves 23 and 23 can open, the valves 24 and 24 will be closed and the lesser circulation way 22 will be formed, the small sized pump 21 drives and cooling water circulates through the inside of the lesser circulation way 22. In this case, although the electric heaters 25 and 25 operate and the fuel cell 1 top and the lower end part side are heated by these electric heaters 25 and 25, In order that the cooling water which flows through the inside of the condensator 2 of the plurality in the fuel cell 1 may also be heated by these electric heaters 25 and 25 and may return to warm water, The heat on the fuel cell 1 given by the electric heaters 25 and 25 and by the side of a lower end part is promptly drawn also in the pars intermedia side of the fuel cell 1 by this condensator 2, and the fuel cell 1 is uniformly heated by the prescribed temperature in which an internal electrolyte (for example, phosphoric acid) does not freeze over.

[0020]Namely, in carrying out heating maintenance of the fuel cell 1 at prescribed temperature at the time of the shutdown of a device, the lesser circulation way 22 with little holding water quantity is received, In order to heat the cooling water in this lesser circulation way 22 to prescribed temperature with the electric heaters 25 and 25 and to try only for a necessary minimum quantity to circulate this cooling water with the small sized pump 21, Power consumption which heating of the cooling water and the drive of a pump take the warm water of prescribed temperature in the cooling water circuit 9 with much holding water quantity of cooling water compared with the case of the former circulated so much with the circulating pump 7 can be made [small] remarkable, and reduction of operating cost can be aimed at. Since soak-ization is attained via the condensator 2 when heating the fuel cell 1 with the electric heaters 25 and 25, the capacity of these electric heaters 25 and 25 is also the minimum thing, it can clear up, and the small size and miniaturization of a device can be attained.

[0021]example 2. -- this Example 2 is one example concerning the invention of the 2nd of this invention. Drawing 2 is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant in which Example 2 of this invention is shown. In this Example 2, the electric heaters 25 and 25 were not formed in a lower end part on the fuel cell 1, but the heating apparatus 26 which serves as a heating method of the fuel cell 1 at the downstream of the small sized pump 21 of the bypass piping 20 is formed. Other composition is the same as that of the fuel cell type power plant of the above-mentioned Example 1.

[0022]And when operation of a device is suspended, while opening the valves 23 and 23, shutting the valves 24 and 24, forming the lesser circulation way 22 and making the small sized pump 21 drive also in this Example 2, If it is made to circulate, operating the heating apparatus 26 and heating the cooling water in the lesser circulation way 22 to prescribed temperature, the fuel cell 1 can be maintained during the shutdown via the condensator 2 more than prescribed temperature, and freezing of the electrolyte in the fuel cell 1 can be prevented. Also in this case, the heating apparatus 26 should just have the capacity which can heat the cooling water in the lesser circulation way 22 to prescribed temperature, and can acquire the same effect as the above-mentioned Example 1. In this Example 2, since cooling water is directly heated with the heating apparatus 26 [especially / the case of the above-mentioned Example 1], while not producing a temperature gradient at all in the fuel cell 1, the further small-capacity-izing and

miniaturization of a heating method can be attained.
[0023]example 3. -- this Example 3 is other examples concerning the invention of the 2nd of this invention. Although the inside of the lesser circulation way 22 shall be circulated in the above-mentioned Example 2, allocating the heating apparatus 26 in the lesser circulation way 22, and heating cooling water to prescribed temperature during the shutdown of the fuel cell 1, As shown by drawing 3, in this Example 3, form the temperature controller 27 in the heating apparatus 26, and with this temperature controller 27. The heating apparatus 26 shall be controlled, the fuel cell 1 can be made to hold to a fixed temperature during the shutdown, measuring the temperature of the fuel cell 1, and heating of a fuel cell is not made to produce excess and deficiency.
[0024]example 4. -- this Example 4 is one example concerning the invention of the 3rd of this invention.

TECHNICAL FIELD

[Industrial Application]This invention relates to the fuel cell type power plant which has a fuel cell of a water cooling system.

PRIOR ART

[Description of the Prior Art]Since a fuel cell generates heat by an electromotive loss at the time of power generation, it cools by a certain means and it is necessary to make it the temperature of this fuel cell not rise generally more than prescribed temperature. In [drawing 6 is a cooling-system figure of the circumference of the fuel cell of the conventional fuel cell type power plant shown in JP,2-260370,A, and] a figure, 1 For example, the fuel cell with which many cells are laminated by the sliding direction, the condensator with which 2 is inserted for every cell of a predetermined number into this fuel cell 1, The water supply piping by which 3 supplies cooling water to the condensator 2, the drain piping in which 4 picks out cooling water from the condensator 2, The steam separator with which 5 is connected with the end part of the drain piping 4, and 6 are taken out from the lower part of the steam separator 5, The circulating pump of meteoric water piping connected with the water supply piping 3, and the cooling water in which 7 was provided into the water supply piping 3, Makeup water piping and 11 are steam pipings the drum heaters of the power use provided in the steam separator 5 8, the cooling water circuit in which 9 is formed of the steam separator 5, the meteoric water piping 6, the water supply piping 3, the circulating pump 7, the condensator 2, and the drain piping 4, and 10.
[0003]Operation of this fuel cell type power plant is explained below. If the fuel cell 1 is operated and power generation is started with this fuel cell type power plant, the fuel cell 1 will generate heat by that electromotive loss, and temperature will rise. For this reason, when the circulating pump 7 is started, and the cooling water in the steam separator 5 is sent in the condensator 2 through the water supply piping 3 and evaporates within this condensator 2, the generating heat of the fuel cell 1 is absorbed and the temperature of this fuel cell 1 is maintained to a predetermined operating temperature. And the cooling water of the vapor-liquid mixed phase discharged from the condensator 2 is emitted in the steam separator 5 via the drain piping 4, and vapor-liquid is separated by this steam separator 5. And while the load side which steam is

adjusted to predetermined pressure and needs steam via the steam pipings 11 is supplied, it circulates through saturated water again with the circulating pump 7 through the meteoric water piping 6.
[0004]While new cooling water is supplied via the makeup water piping 10 by the steam emitted to the load side by the steam pipings 11, The amount of supply of the steam to a load side is maintained by constant value by the drum heaters' 8 operating and generating the steam which runs short within the steam separator 5 by the load change of the fuel cell 1, etc., if the amount of evaporation of the cooling water by the condensator 2 falls.
[0005]Now, when operation of the fuel cell type power plant which has the fuel cell 1 of the above water cooling types is suspended, in order to prevent freezing of the electrolyte currently held in the fuel cell 1, for example, phosphoric acid, It is necessary to hold the temperature of this fuel cell 1 more than prescribed temperature (in for example, the case of phosphoric acid 50-60 **). For this reason, operating the drum heaters 8 and holding the temperature of cooling water more than prescribed temperature, even if operation of a device is suspended. This cooling water is circulated all over the cooling water circuit 9 with the circulating pump 7, and prevention of electrolytic freezing is achieved by heating the fuel cell 1 via the condensator 2 more than prescribed temperature.
[0006]As shown by drawing 7, the electric heaters 12 and 12 are formed in a lower end part on the fuel cell 1, the electric heaters 12 and 12 are operated at the time of the shutdown of a device, the temperature of the fuel cell 1 is held beyond a predetermined value, and there are some by which prevention of electrolytic freezing is made.

EFFECT OF THE INVENTION

[Effect of the Invention]It comprises this invention as mentioned above.
Therefore, an effect which is indicated below is done so.

[0029]The condensator which was attached in the fuel cell according to the invention of the 1st of this invention, By making a cooling water circuit with the water supply piping which performs the feed water to a condensator, and the drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing the bypass piping which provides a heating method in the both ends of a fuel cell, and connects water supply piping and drain piping with the 1 side of a fuel cell in the fuel cell type power plant with which cooling of a fuel cell is made by a condensator, Since the small sized pump made to circulate through the cooling water heated via a heating method on the lesser circulation way included a condensator and bypass piping was formed during bypass piping at the time of the shutdown of a device, While being able to make small capacity of a heating method and a small sized pump and being able to aim at reduction of operating cost in the anti-icing of the electrolyte of the fuel cell at the time of the shutdown of a device, miniaturization of a device can also be attained collectively.
[0030]The condensator which was attached in the fuel cell according to the invention of the 2nd of this invention, By making a cooling water circuit with the water supply piping which performs the feed water to a condensator, and the drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing the bypass piping which connects water supply piping and drain piping

with the 1 side of a fuel cell in the fuel cell type power plant with which cooling of a fuel cell is made by a condensator, Since the heating method was established during bypass piping and the small sized pump made to circulate through the cooling water heated by a heating method was formed in the lesser circulation way included a condensator and bypass piping at the time of the shutdown of a device, While being able to aim at reduction of operating cost like the 1st invention in the anti-icing of the electrolyte of the fuel cell at the time of the shutdown of a device, miniaturization of a device can also be attained collectively.
[0031]The condensator which was furthermore attached in the fuel cell according to the invention of the 3rd of this invention, By making a cooling water circuit with the water supply piping which performs the feed water to a condensator, and the drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing the bypass piping which connects water supply piping and drain piping with the 1 side of a fuel cell in the fuel cell type power plant with which cooling of a fuel cell is made by a condensator, Since the small heating pump circulated heating cooling water on the lesser circulation way included a condensator and bypass piping at the time of the shutdown of a fuel cell was formed during bypass piping, While being able to aim at reduction of operating cost like the 1st invention in the anti-icing of the electrolyte of the fuel cell at the time of the shutdown of a device, miniaturization of a device can also be attained collectively.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, when operating the drum heaters 8 and circulating cooling water all over the cooling water circuit 9 at the time of the shutdown of a fuel cell type power plant, since there was much holding water quantity in this cooling water circuit 9, the power usage of the drum heaters 8 increased and the technical problem that operating cost will go up occurred. In order to circulate cooling water all over the cooling water circuit 9, when driving the large-sized circulating pump 7, the power usage also had the technical problem that it will be large, and operating cost will go up and carry out also by this.
[0008]When heating a lower end part with the electric heaters 12 and 12 on the fuel cell 1, In order to secure the temperature of pars intermedia more than prescribed temperature since the temperature of pars intermedia does not rise easily on the fuel cell 1 compared with a lower end part as shown by drawing 8, The top needed to heat the lower end part unnecessarily, and while causing increase of power usage and causing the rise of operating cost, the technical problem that enlargement of a device will be caused with enlargement of the electric heaters 12 and 12 occurred.
[0009]The purpose of this invention is as follows.
It is made in order to solve the above technical problems, and reduction of ********** can be aimed at in the anti-icing of the electrolyte of the fuel cell at the time of the shutdown of a device.
Provide the fuel cell type power plant which can also attain miniaturization of a device.

MEANS

[Means for Solving the Problem]A condensator with which an invention of the 1st of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which provides a heating method in both ends of a fuel cell, and connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having formed a small sized pump made to circulate through cooling water heated via a heating method on a lesser circulation way which included a condensator and bypass piping at the time of shutdown of a device during bypass piping.

[0011]A condensator with which an invention of the 2nd of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having established a heating method during bypass piping and having formed a small sized pump made to circulate through cooling water heated by a heating method in a lesser circulation way included a condensator and bypass piping at the time of shutdown of a device.

[0012]A condensator with which an invention of the 3rd of this invention was attached in a fuel cell, and water supply piping which performs feed water to a condensator, By making a cooling water circuit with drain piping which performs wastewater from a condensator circulate through cooling water via a circulating pump at the time of operation of a device, While providing bypass piping which connects water supply piping and drain piping with 1 side of a fuel cell in a fuel cell type power plant with which cooling of a fuel cell is made by a condensator, It is having formed a small heating pump circulated heating cooling water on a lesser circulation way included a condensator and bypass piping at the time of shutdown of a fuel cell during bypass piping.

OPERATION

[Function]In the invention of the 1st of this invention, during operation of the device with which power generation by a fuel cell is made, a cooling water circuit with water supply piping, a condensator, and drain piping is made to circulate through cooling water with a circulating pump, and a fuel cell is cooled via a condensator. When operation of a device is suspended, while operating a heating method and heating a fuel cell, the small sized pump formed during bypass piping is operated, and the lesser circulation way having contained bypass piping and a condensator is made to circulate through cooling water. The heat given to the fuel cell by the heating method is also told to the cooling water side via a condensator, the whole is uniformly heated by prescribed temperature and, as for a fuel cell, freezing of the electrolyte of a fuel cell is prevented by this. In this case, since the holding water quantity of the cooling water in a lesser circulation way is also small, it is small and can clear up that heating quantity, while it can perform uniform heating of a fuel cell via a condensator, even if a heating method is attached to the both ends of a fuel cell.

[0014]When operation of a device is suspended, the small sized pump and heating method which

were established during bypass piping are operated, and the lesser circulation way having contained bypass piping and a condensator is made to circulate through cooling water in the invention of the 2nd of this invention. The cooling water heated by the heating method flows into a condensator, a fuel cell is heated by prescribed temperature and freezing of that electrolyte is prevented by this.

[0015]The small heating pump formed during bypass piping is operated, and it is made to circulate in the invention of the 3rd of this invention, when operation of a device is suspended, heating cooling water on the lesser circulation way having contained bypass piping and a condensator. It flows into a condensator, cooling water being heated with a small heating pump, a fuel cell is heated by prescribed temperature and freezing of that electrolyte is prevented by this.

EXAMPLE

[Example]Hereafter, the example of this invention is described about a figure.

example 1. -- this Example 1 is one example concerning the invention of the 1st of this invention. Drawing 1 is a cooling-system figure of the circumference of the fuel cell 1 of the fuel cell type power plant in which Example 1 of this invention is shown, gives identical codes to a portion the same as that of the conventional fuel cell type power plant shown by drawing 6, or considerable, and omits that explanation.

[0017]The bypass piping of the small size with which 20 connects the water supply piping 3 and the drain piping 4 in a figure, The small sized pump of small capacity with which 21 was provided during this bypass piping 20, the lesser circulation way of the cooling water in which 22 is constituted including the condensator 2 and bypass piping 20 grade in the fuel cell 1, The valve provided in the valve by which 23 was provided in the both-ends side of the bypass piping 20, the water supply piping 3 by which 24 adjoins the lesser circulation way 22, and the drain piping 4, and 25 are the electric heaters used as the heating method of this fuel cell 1 provided in the lower end part on the fuel cell 1.

[0018]Operation of this fuel cell type power plant is explained below. While the valves 23 and 23 are closed during operation of a device, the valves 24 and 24 can open and cooling water can circulate through the inside of the cooling water circuit 9. And while electric power is taken out by operation of a device with the fuel cell 1, by the drive of the circulating pump 7, cooling water circulates through the inside of the cooling water circuit 9, and the fuel cell 1 is maintained by fixed operating temperature by collecting the generating heat as steam at the steam separator 5 side.

[0019]If operation of a device is suspended next, while the valves 23 and 23 can open, the valves 24 and 24 will be closed and the lesser circulation way 22 will be formed, the small sized pump 21 drives and cooling water circulates through the inside of the lesser circulation way 22. In this case, although the electric heaters 25 and 25 operate and the fuel cell 1 top and the lower end part side are heated by these electric heaters 25 and 25, In order that the cooling water which flows through the inside of the condensator 2 of the plurality in the fuel cell 1 may also be heated by these electric heaters 25 and 25 and may return to warm water, The heat on the fuel cell 1 given by the electric heaters 25 and 25 and by the side of a lower end part is promptly drawn also in the pars intermedia side of the fuel cell 1 by this condensator 2, and the fuel cell 1 is uniformly heated by the prescribed temperature in which an internal electrolyte (for example, phosphoric

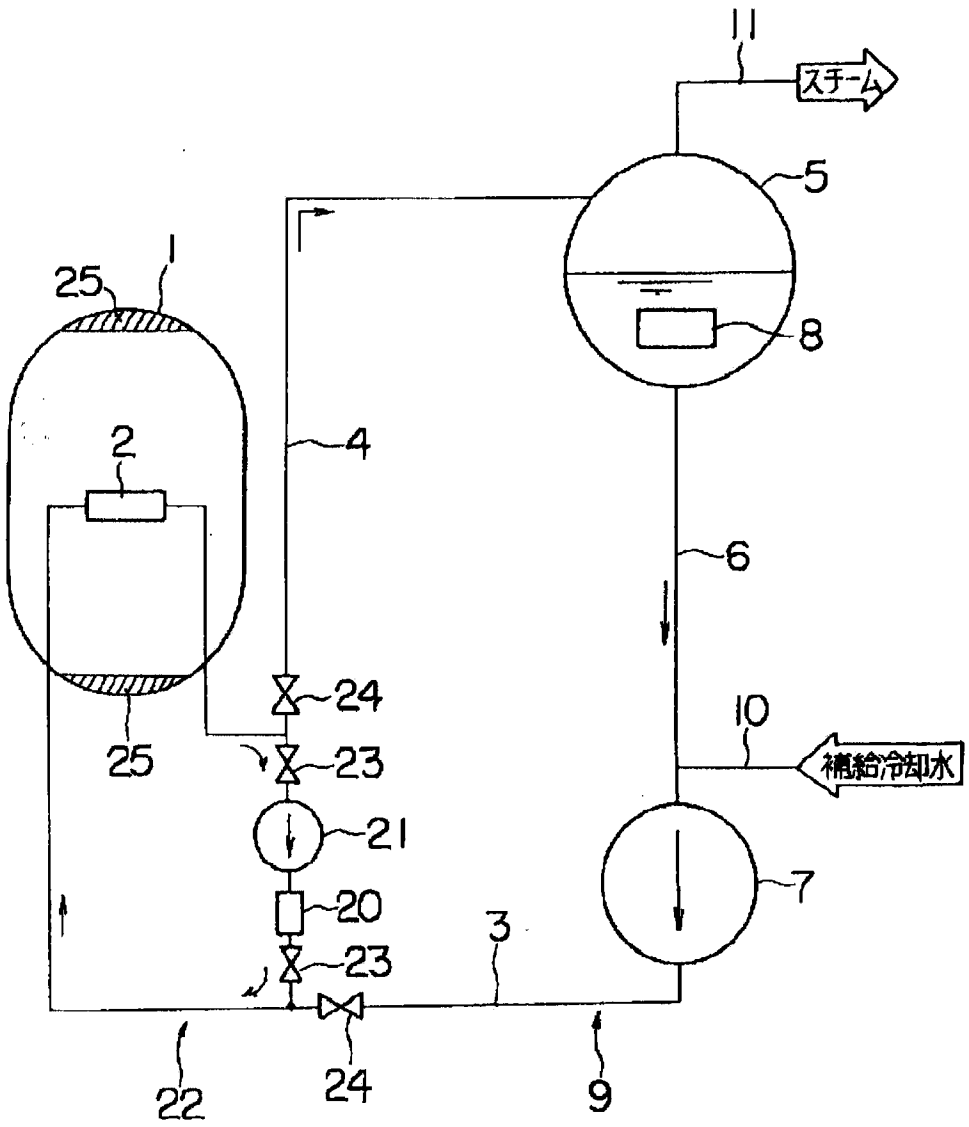
acid) does not freeze over.
[0020]Namely, in carrying out heating maintenance of the fuel cell 1 at prescribed temperature at the time of the shutdown of a device, the lesser circulation way 22 with little holding water quantity is received, In order to heat the cooling water in this lesser circulation way 22 to prescribed temperature with the electric heaters 25 and 25 and to try only for a necessary minimum quantity to circulate this cooling water with the small sized pump 21, Power consumption which heating of the cooling water and the drive of a pump take the warm water of prescribed temperature in the cooling water circuit 9 with much holding water quantity of cooling water compared with the case of the former circulated so much with the circulating pump 7 can be made [small] remarkable, and reduction of operating cost can be aimed at. Since soak-ization is attained via the condensator 2 when heating the fuel cell 1 with the electric heaters 25 and 25, the capacity of these electric heaters 25 and 25 is also the minimum thing, it can clear up, and the small size and miniaturization of a device can be attained.
[0021]example 2. -- this Example 2 is one example concerning the invention of the 2nd of this invention. Drawing 2 is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant in which Example 2 of this invention is shown. In this Example 2, the electric heaters 25 and 25 were not formed in a lower end part on the fuel cell 1, but the heating apparatus 26 which serves as a heating method of the fuel cell 1 at the downstream of the small sized pump 21 of the bypass piping 20 is formed. Other composition is the same as that of the fuel cell type power plant of the above-mentioned Example 1.
[0022]And when operation of a device is suspended, while opening the valves 23 and 23, shutting the valves 24 and 24, forming the lesser circulation way 22 and making the small sized pump 21 drive also in this Example 2, If it is made to circulate, operating the heating apparatus 26 and heating the cooling water in the lesser circulation way 22 to prescribed temperature, the fuel cell 1 can be maintained during the shutdown via the condensator 2 more than prescribed temperature, and freezing of the electrolyte in the fuel cell 1 can be prevented. Also in this case, the heating apparatus 26 should just have the capacity which can heat the cooling water in the lesser circulation way 22 to prescribed temperature, and can acquire the same effect as the above-mentioned Example 1. In this Example 2, since cooling water is directly heated with the heating apparatus 26 [especially / the case of the above-mentioned Example 1], while not producing a temperature gradient at all in the fuel cell 1, the further small-capacity-izing and miniaturization of a heating method can be attained.
[0023]example 3. -- this Example 3 is other examples concerning the invention of the 2nd of this invention. Although the inside of the lesser circulation way 22 shall be circulated in the above-mentioned Example 2, allocating the heating apparatus 26 in the lesser circulation way 22, and heating cooling water to prescribed temperature during the shutdown of the fuel cell 1, As shown by drawing 3, in this Example 3, form the temperature controller 27 in the heating apparatus 26, and with this temperature controller 27. The heating apparatus 26 shall be controlled, the fuel cell 1 can be made to hold to a fixed temperature during the shutdown, measuring the temperature of the fuel cell 1, and heating of a fuel cell is not made to produce excess and deficiency.
[0024]example 4. -- this Example 4 is one example concerning the invention of the 3rd of this invention.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant about Example 1 of this invention.
[Drawing 2]It is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant about Example 2 of this invention.
[Drawing 3]It is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant about Example 3 of this invention.
[Drawing 4]It is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant about Example 4 of this invention.
[Drawing 5]It is a cooling-system figure of the circumference of the fuel cell of the fuel cell type power plant about Example 5 of this invention.
[Drawing 6]It is a cooling-system figure of the circumference of the fuel cell of the conventional fuel cell type power plant.
[Drawing 7]It is a figure showing the fuel cell with which the electric heater was attached to the lower end part on the conventional fuel cell type power plant.
[Drawing 8]It is a figure showing the temperature distribution in the fuel cell of drawing 7.
[Description of Notations]
1 Fuel cell
2 Condensator
3 Water supply piping
4 Drain piping
7 Circulating pump
9 Cooling water circuit
20 Bypass piping
21 Small sized pump
22 Lesser circulation way
25 Electric heater (heating method)
26 Heating apparatus (heating method)
28 Small heating pump

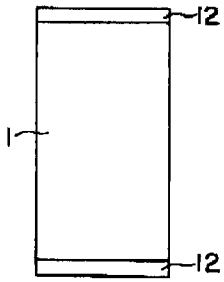
DRAWINGS

[Drawing 1]

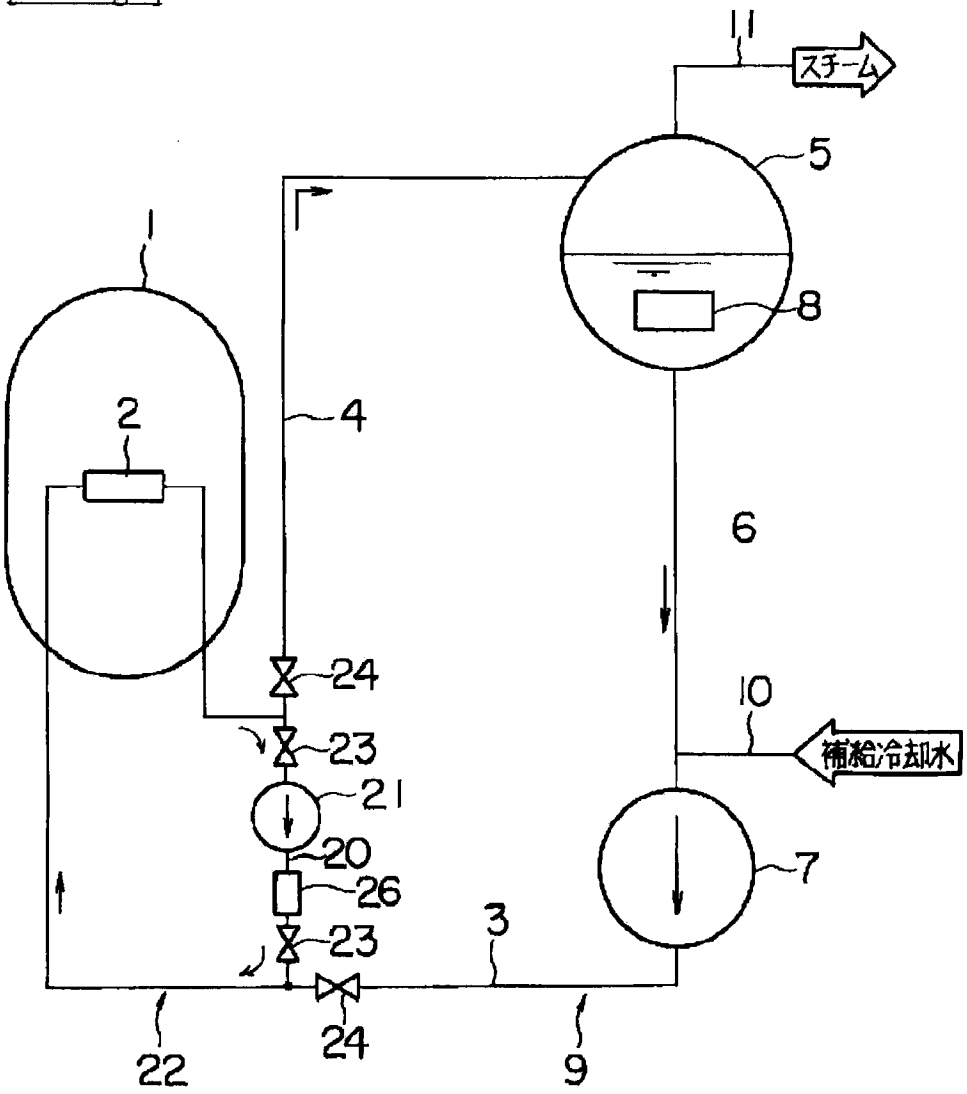


1：燃料電池
2：冷却器
3：給水配管
4：排水配管
7：循環ポンプ
9：冷却水循環路
20：バイパス配管
21：小型ポンプ
22：電気ヒータ（加熱手段）

[Drawing 7]

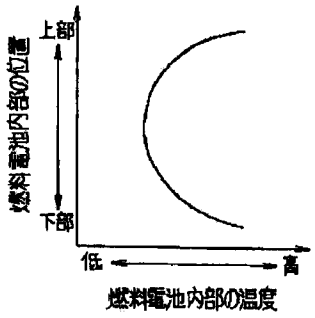


[Drawing 2]

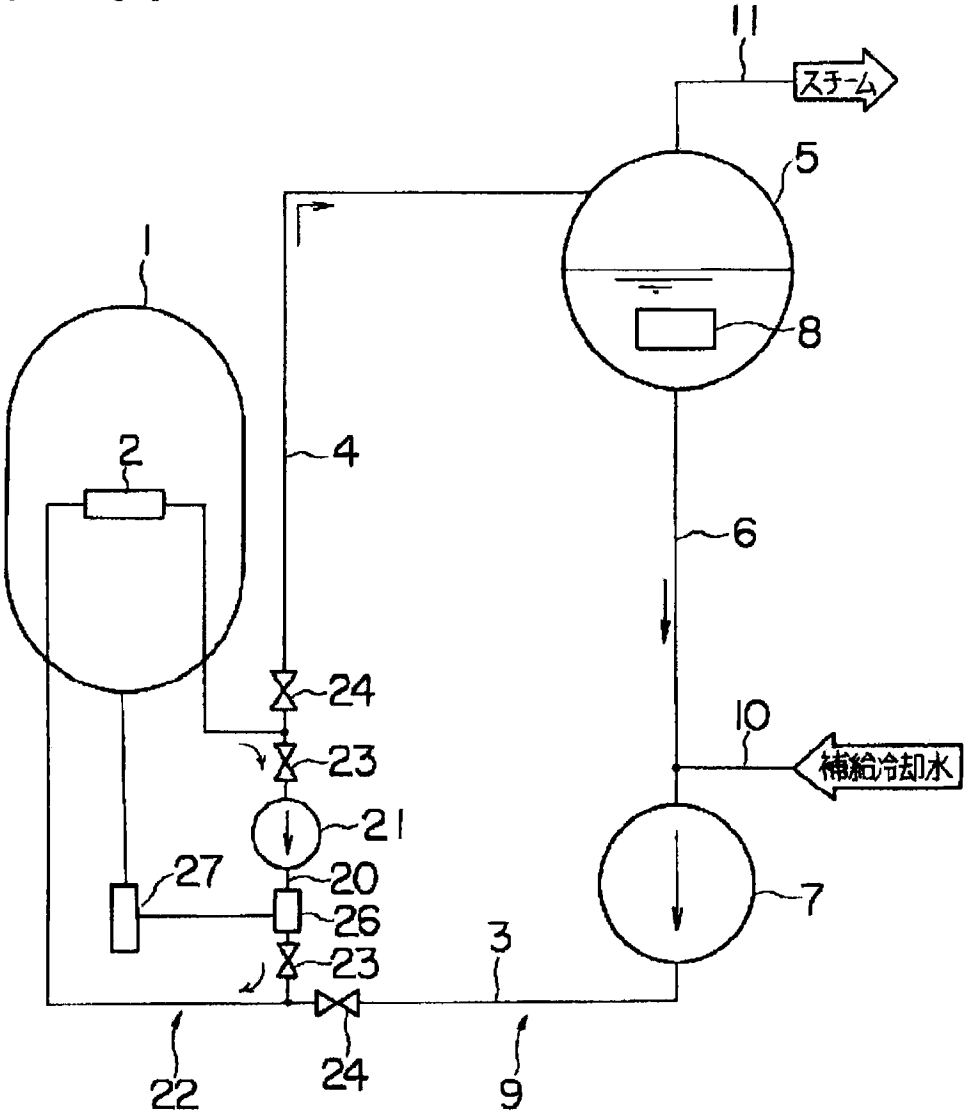


26：加熱装置（加熱手段）

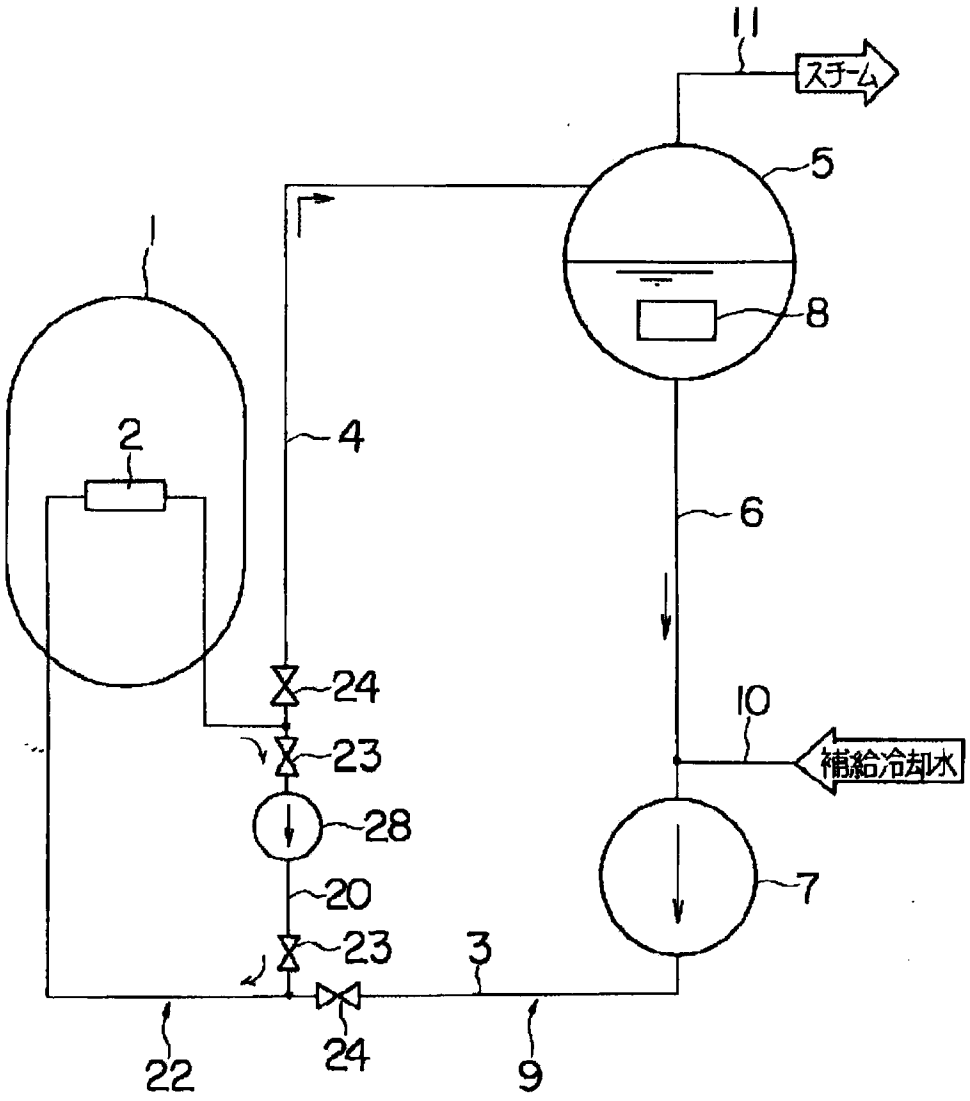
[Drawing 8]



[Drawing 3]

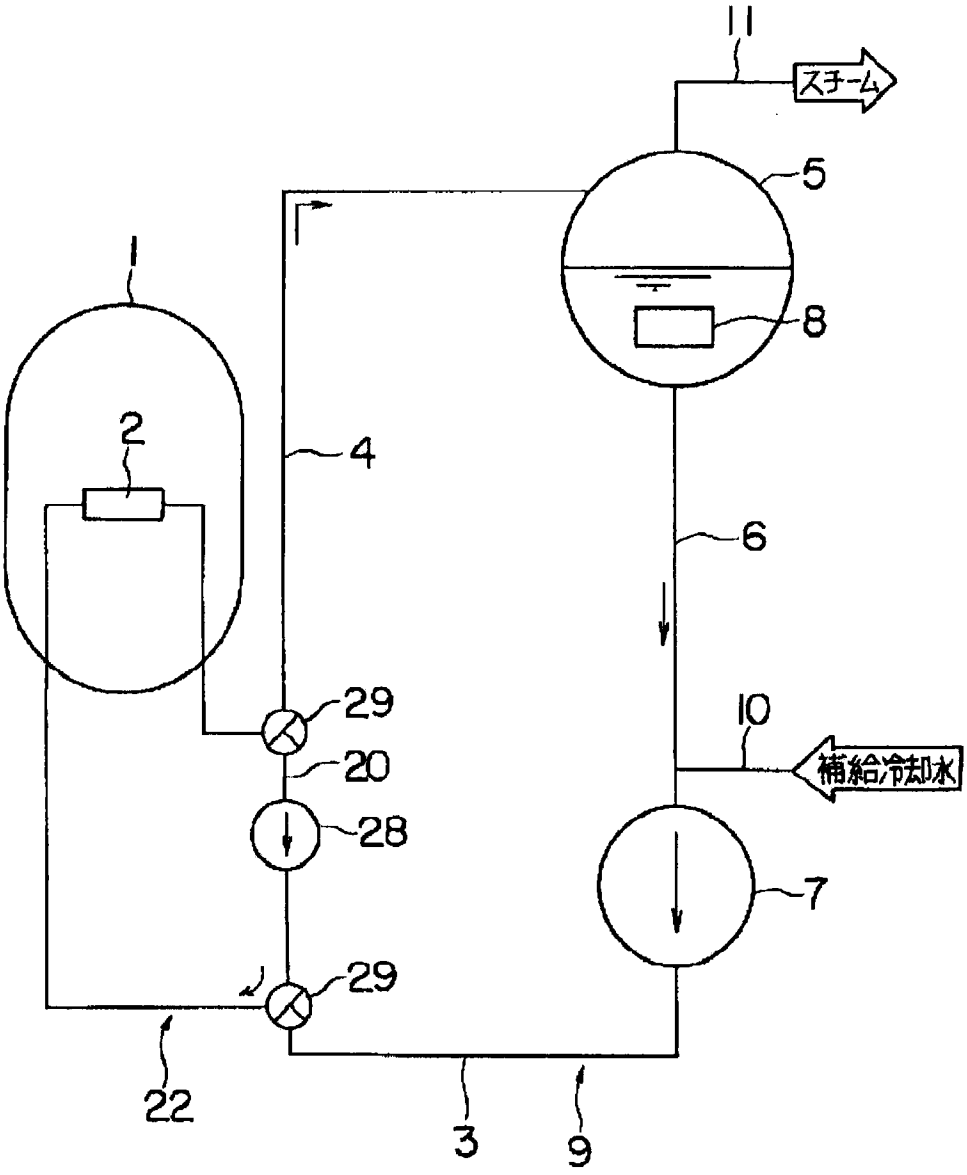


[Drawing 4]

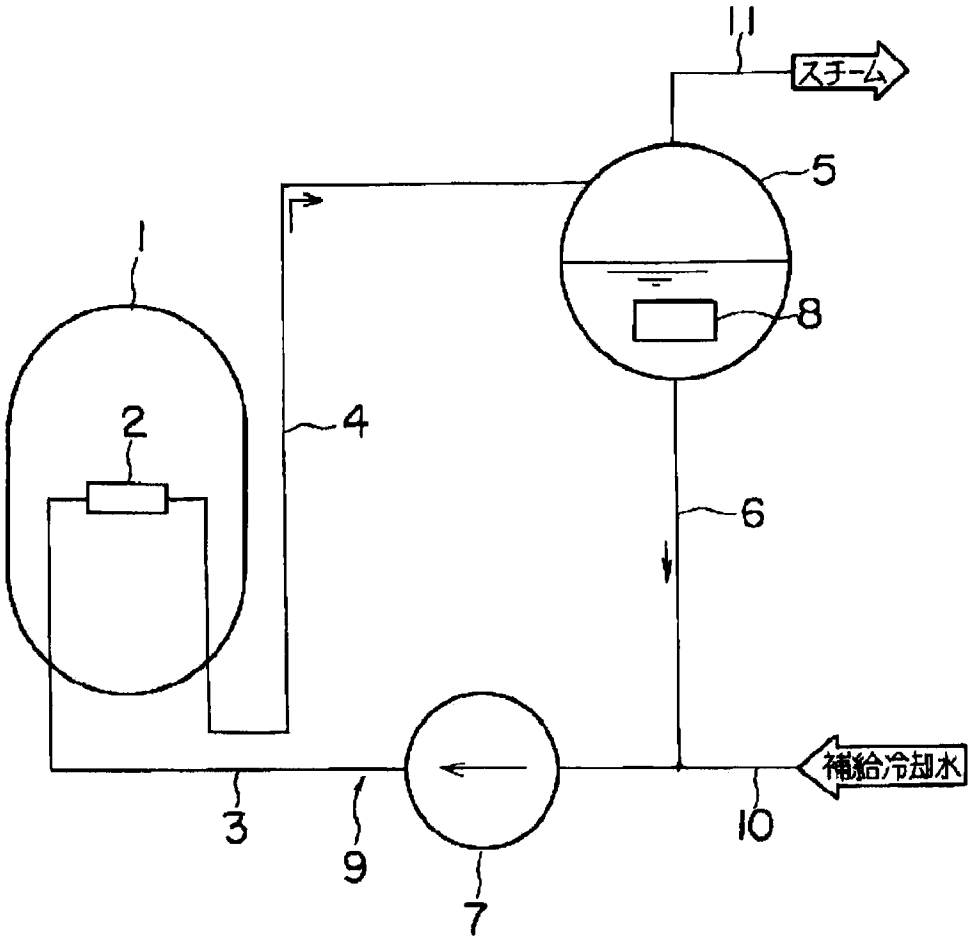


28：小型加熱ポンプ

[Drawing 5]



[Drawing 6]



[Translation done.]